

REMARKS/ARGUMENTS

Claims 1, 3-13 and 16-35 are active in this application, Claims 2 and 14-15 having been canceled. Claim 8 has been amended to correct informalities as recommended by the Examiner to more specifically identify the four successive reaction zones, and to remove the phrase “preferably hydrogen”. Additionally, Claim 8 has been amended to provide antecedent basis for the “hot reaction mixture”. These amendments are supported by the claim as originally filed. New claim 36 has been added and is supported by original claim 14. The new brief description of the Figures is supported by the specification as filed. No new matter has been added by the amendment.

The present invention relates to a composition comprising nanoscale pyrogenically produced zinc oxide powder and the process for its production. The zinc powder of the present invention has a BET surface area of 10-200 m²/g, and the composition is in the form of aggregates of anisotropic primary particles. The aggregates display an average diameter of 50-300 nm and comprise a mixture of nodular primary particles and acicular primary particles wherein the ratio of nodular to acicular particles is between 99:1 and 1:99.

An important factor in obtaining such particles of the required BET surface area and average diameter of the aggregates, with the aggregates being a mixture of nodular primary particles and acicular primary particles, is the process by which the particles are produced. In particular, the process of the present invention Claim 8 requires that the zinc powder be converted to zinc oxide powder in four successive reaction zones, those being an evaporation zone, a nucleation zone, an oxidation zone and a quench zone. In the evaporation zone, the zinc powder is conveyed by an inert gas stream and is evaporated to produce zinc vapor using a flame formed from a mixture of fuel gas with either air or oxygen or both. Further, it is required that the reaction parameters be chosen such that oxidation of the zinc does not occur in the evaporation zone. One manner in which this is achieved is by using an excess of fuel

gas, as described in the present application. After the evaporation zone, the resulting hot reaction mixture which consists of zinc vapor, water vapor (as a reaction product from the formation of the flame and optionally excess fuel gas), arrives from the evaporation zone and is cooled to a temperature below the boiling point of zinc. This step is important as it creates nucleation and the formation of zinc crystallites. These zinc crystallites are then passed into the oxidation zone where they are oxidized with air and/or oxygen to generate zinc oxide. Thus, the present invention process oxidizes zinc to zinc oxide when it is in a quasi-solid state, as compared to the conventional process which oxidizes zinc vapor to create zinc oxide vapor followed by cooling to generate particles. Following oxidation in the present invention, the resulting zinc oxide is passed into a quench zone where it is cooled to temperature of below 400°C and the zinc oxide powder is then separated from the gas stream.

Applicants have found that by performing the present claimed process the resulting zinc oxide powder possesses the characteristics of Claim 1, namely the required BET surface area and the formation of these aggregates of anisotropic primary particles which are a mixture of nodular primary particles and acicular particles. The aggregates have an average diameter of 50-300 nm.

The objection to Claim 8 and the rejection of Claims 8-13, 16, 18, 22, 23, 24, 26 and 28-35 under 35 U.S.C. §112, second paragraph are believed to be obviated by the above amendments, and where not obviated is respectfully traversed. The Examiner has questioned how the parameters in the evaporation zone are chosen such that oxidation of the zinc does not occur, particularly in light of the use of a flame of air and/or oxygen and fuel gas. Applicants note that one of ordinary skill in the art would understand based upon the description in the specification and the claim that the evaporation zone uses a flame which is formed by combustion of fuel gas with air and/or oxygen as the flame source. The combustion of fuel gas with air and/or oxygen results in consumption of the oxygen present

in producing the flame in order to avoid oxidation within the evaporation zone. This is described throughout the specification but particularly at page 3, lines 17-20. One way in which the process parameters are set to avoid oxidation is further described at page 5, lines 7-9 where it is specified that the process can be performed in such a way that in the evaporation zone an excess of fuel gas is used. Accordingly, Claim 8 is believed to be definite as written and the rejection should be withdrawn.

The objection to the specification has also been obviated by the present amendment and where not obviated is respectfully traversed. The Examiner's objection to the specification for failure to provide antecedent basis for Claims 16-26 is not understood as the specification specifically indicates at page 6, lines 12-15 that the powder according to the invention can be used as a sunscreen, a vulcanizing agent, a dye in inks, in synthetic resins, in pharmaceutical and cosmetic preparations, as a ceramic raw material and as a catalyst. The Claims 16-26 are based upon this use specified in the paragraph noted. Accordingly, the claims are believed to be supported by the specification and the rejection should be withdrawn.

Claims 1, 3-13, 20-22 and 28-35 stand rejected under 35 U.S.C. §103 over Yoshimaru et al. in view of Cyr and Hunter. Claims 16-19 and 23-27 stand rejected under 35 U.S.C. §103 over Yoshimaru et al. in view of Cyr and Hunter and further in view of Laundon or Wang et al. or Spencer or Jenkins et al. None of these references, alone or in combination, disclose or suggest a composition of nanoscale pyrogenically produced zinc oxide powder as required in the present invention, nor a method for producing such a composition.

The Examiner's primary reference is Yoshimaru et al. The Examiner takes the position that the process taught by Yoshimaru et al. is substantially similar to that of the present claims. However, Yoshimaru et al. teaches a process which requires generation of zinc vapor (which is uniformly mixed with the vapor of a dopant forming metal compound),

wherein the vapor mixture is injected directly into the oxidation chamber **wherein the vapor is oxidized** (see paragraph bridging columns 4 and 5 and paragraph bridging columns 5 and 6 of Yoshimaru et al.). Such a method **omits** a critical step of the presently claimed method, namely that of nucleation. In the present invention, the zinc vapor is passed into a nucleation zone and cooled to temperatures below the boiling point of zinc in order to facilitate the formation of zinc crystallites, which can be thought of as quasi-particles of zinc. It is these zinc crystallites or particles that are then provided to the oxidation zone and oxidized with air or oxygen in the present invention. This process of evaporation, nucleation and oxidation results in the unique primary particle structure and resulting surface area of the aggregates of the present invention zinc oxide powder. Yoshimaru et al. cannot suggest such a process nor such a powder having the required BET surface area, and aggregate composition.

Neither Cyr nor Hunter are sufficient to overcome the deficiencies of Yoshimaru et al. Hunter merely discloses a method for providing the manufacture of zinc from zinc ores by vaporizing zinc from the zinc ore followed by liquification of the vaporized zinc and solidification of the pure zinc. There is no disclosure in Hunter of oxidation of the zinc. Accordingly, a combination of Hunter with Yoshimaru et al. still would not arrive at the present invention as there is nothing within Hunter to suggest modifying Yoshimaru et al. to require oxidation of zinc after nucleation of the zinc vapor.

Cyr likewise cannot modify the teachings of Yoshimaru et al. to arrive at the present invention as Cyr, like Yoshimaru, also oxidizes zinc vapor **without a nucleation step**. Accordingly, the combination of these references cannot render the present invention obvious nor result in the present invention zinc oxide particle composition and the rejection should be withdrawn.

The rejection of Claims 16-19 and 23-27 also relies on this combination of Yoshimaru et al. in view of Cyr and Hunter, then requires the use of one of several references describing

the use of zinc oxide in various end uses. Since none of these secondary references teach anything further with respect to how to modify Yoshimaru et al. or Cyr or Hunter to arrive at the present invention process or zinc oxide particle composition, these references cannot combine with Yoshimaru et al., Cyr or Hunter to render the present invention obvious and the rejection should be withdrawn.

The rejection of Claims 1, 3-13, 16-17 and 28-35 for obviousness-type double patenting over Claims 1-20 of U.S. Patent 7,235,298 (Applicants note that the Examiner's rejection contains an error in the patent number, while reciting the proper application number) is respectfully traversed. Applicants note that the present application has an effective U.S. filing date of March 10, 2003, the date of the filing of the PCT application to which the present application claims priority, and the present application has a U.S. filing or 371(c) date of August 24, 2004. The '298 patent, on the other hand, has a PCT filing date of July 7, 2003 and 371(c) filing date of February 1, 2005, both of which are after the respective dates of the present application. Yet, the '298 patent issued prior to the present application through no fault of the present Applicants.

Such a situation falls squarely within the four corners of the holding in *In re Braat*, 19 USPQ2d 1289 (Fed. Cir. 1991) which held that in a situation such as the present application where a later filed application issues first, the patent office is required to show two-way obviousness for the claims in question rather than just one-way obviousness as the Examiner has done in the present Office Action. Two-way obviousness requires that the claims of the present application be obvious based upon the claims of the issued patent and that the claims of the issued patent be obvious based upon the claims of the pending application. That cannot be shown in the present case, since the claims of the '298 patent require a doping component selected from a specific grouping of metal oxides in a particular percentage while the present invention specifies nothing with respect to a dopant. Further, there is nothing

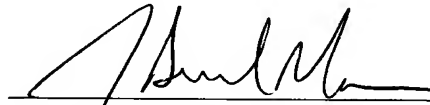
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within the claims of the '298 patent regarding the aggregates of zinc oxide particles being a combination of nodular primary particles and acicular primary particles, which is a specific requirement of the present invention. As such, it is not believed that even one-way obviousness has been shown based upon the claims of the '298 patent, and certainly there can be no two-way obviousness between the claims of the present application and the '298 patent. Accordingly, the rejection should be withdrawn.

Applicants submit that the application is now in condition for allowance, and early notification of such action is earnestly solicited.

Respectfully submitted,

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